CHAPTER 5

SPECIFICATIONS/MATERIAL ESTIMATING/ADVANCED BASE PLANNING

As an Engineering Aid assigned to either a construction battalion or a Public Works Department, you may be required to assist in the preparation of specifications for a construction project. You will, most certainly, use construction specifications in your day-to-day job, especially when surveying or testing materials. This chapter briefly discusses the organization and content of construction specifications.

In addition, EAs frequently are involved in estimating material requirements for a project and assisting in the planning of advanced bases. This chapter introduces you to those topics.

SPECIFICATIONS

Because many aspects of construction cannot be shown graphically, even the best prepared construction drawings are most often not entirely adequate in revealing all the aspects of a construction project; for instance, how can anyone show on a drawing the quality of workmanship required for the installation of doors and windows or who is responsible for supplying the materials, except by extensive hand-lettered notes? The standard procedure then is to supplement construction drawings with detailed written instructions. These written instructions, called **specifications** (or more commonly specs), define and limit the materials and fabrication according to the intent of the engineer or the designer.

Usually, it is the design engineer's responsibility to prepare project specifications. As an EA, you maybe required to help the engineer in doing this. You also will be required to read, interpret, and use specifications in your work performance as a surveyor or soils technician. To help the engineer in writing specs, you need to be familiar with the various types of reference specifications that are used in preparing project specs. These reference specifications include various federal, military, and nongovernmental specifications. When assisting the engineer in preparing specifications or when using specifications, you also need to be familiar with the general format and terminology used in specifications. This section provides that familiarity.

NAVFAC SPECIFICATIONS

NAVFAC specifications are prepared by the Naval Facilities Engineering Command (NAVFACENGCOM), which sets forth standards for all construction work performed under its jurisdiction. This includes work performed by the Seabees. There are three types of NAVFAC specifications. These types are discussed as follows:

1. **NAVFACENGCOM GUIDE SPECIFICATIONS (NFGS).** NAVFACENGCOM guide specifications are the primary basis for preparing specifications for construction projects. These specifications define and establish minimum criteria for construction, materials, and workmanship and must be used as guidance in the preparation of project specifications. Each of these guide specifications (of which there are more than 300) has been written to encompass a wide variety of different materials, construction methods, and circumstances, and must be tailored to suit the work actually required by the specific project. To better explain this, let's look at figure 5-1, which is a page taken from a NAVFACENGCOM guide specification. In this figure, you can see that there are two paragraphs numbered 3.2.1. This indicates that the spec writer must choose the paragraph that best suits the particular project for which he is writing the specification. The capital letters *I* and *J* in the right-hand margin next to those paragraphs refer to footnotes (contained elsewhere in the same guide specification) that the spec writer must follow when selecting the best paragraph. Additionally, you can see that some of the information in figure 5-1 is enclosed in brackets ([ ]). This indicates other choices that the spec writer must make. Guide specifications, also, should be modified and edited to reflect the latest proven technology, materials, and methods.

2. **EFD REGIONAL GUIDE SPECIFICATIONS.** These specifications are used in the same way as the NAVFACENGCOM guide specifications but are used only in an area that is under the jurisdiction of one of the engineering field divisions (EFDs) of the Naval Facilities Engineering Command. When the spec writer is given a choice between using an EFD regional guide specification or a NAVFACENGCOM guide

PART 3 - EXECUTION

3.1 SURFACES AND CONDITIONS: Do not apply shingle roofing on surfaces that are unsuitable or that will prevent a satisfactory application. Ensure that roof deck is smooth, clean, dry, and without loose knots. Cover knotholes and cracks with sheet metal nailed securely to the sheathing. Properly flash and secure vents and other roof projections and drive projecting nails firmly home.

3.2 APPLICATION: The manufacturer's written instructions shall be followed for applications not listed in this specification and in cases of conflict with this specification.

3.2.1 Underlayment (for Roof Slopes 4 Inches Per Foot and Greater): (I)
Apply underlayment consisting of one layer of No. 15 asphalt-saturated felt to the roof deck. Lay felt parallel to roof eaves continuing from eaves to ridge, using 2-inch head laps, 6-inch laps from both sides over all hips and ridges, and 4-inch end laps in the field of the roof. Nail felt sufficiently to hold until shingles are applied. Turn underlayment up vertical surfaces not less than 4 inches.

** OR **

3.2.1 Underlayment (for Roof Slopes [Between 2 Inches and 4 (I)
Inches Per Foot] [4 Inches Per Foot and Greater]): Apply underlayment (J)
consisting of two layers of No. 15 asphalt-saturated felt to the roof deck. Provide a 19-inch wide strip of felt as a starter sheet to maintain the specified number of layers throughout the roof. Lay felt parallel to roof eaves continuing from eaves to ridge, using 19-inch head laps for 6-inch laps from both sides over all hips and ridges, and 12-inch end laps in the field of the roof. Nail felt sufficiently to hold until shingles are applied. Confine nailing to the upper 17 inches of each felt. Turn underlayment up vertical surfaces not less than 4 inches.

3.2.2 Metal Drip Edges: Provide metal drip edges as specified in Section 07600, "Flashing and Sheet Metal," applied directly on the wood deck at the eaves and over the underlayment at the rakes. Extend back from the edge of the deck not more than 3 inches and secure with fasteners spaced not more than 10 inches on center along the inner edge.

[3.2.3 Eaves Flashing (for Roof Slopes 4 Inches Per Foot and (K)
Greater): Provide eaves flashing strips consisting of 55-pound or heavier smooth-surface roll roofing. The flashing strips shall overhang the metal drip edge 1/4 to 3/8 inch and extend up the slope far enough to cover a point 12 inches inside the interior face of the exterior wall. Where overhangs require flashings wider than 36 inches, locate the laps outside the exterior wall face. The laps shall be at least 2 inches wide and cemented. End laps shall be 12 inches and cemented.]

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Figure 5-1.—Sample page from a NAVFACENGCOM guide specification.

specification with the same identification number, the writer must use the one that has the most recent date. This is because there can only be one valid guide specification for a particular area at any one time.

3. **STANDARD SPECIFICATIONS.** These specifications are written for a small group of specialized structures that must have uniform construction to meet rigid operational requirements. NAVFAC standard specifications contain references to federal, military, other command and bureau, and association specifications. NAVFAC standard specifications are referenced or copied in project specifications. When it is necessary to modify requirements of a standard specification, it must be referenced and exceptions taken.

EXAMPLE: "The magazine shall be Arch, Type I, conforming to Specifications S-M8E, except that all concrete shall be Class F- 1."

OTHER SPECIFICATIONS

The following specifications establish requirements mainly in terms of performance. Referencing these documents in project specifications assures the procurement of economical facility components and services while considerably reducing the verbiage required to state such requirements.

1. **FEDERAL AND MILITARY SPECIFICATIONS. Federal specifications** cover the characteristics of materials and supplies used jointly by the Navy and other government agencies. These specifications do not cover installation or workmanship for a particular project but specify the technical requirements and tests for materials, products, or services. The engineering technical library should contain all of the commonly used federal specifications pertinent to Seabee construction. Military specifications are those specifications that have been developed by the Department of Defense. Like federal specifications, they also cover the characteristics of materials. They are identified by "DOD" or "MIL" preceding the first letter and serial number.

2. **TECHNICAL SOCIETY AND TRADE ASSOCIATION SPECIFICATIONS. Technical society specifications—** for example, those published by the American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), Underwriter's Laboratories (UL), and American Iron and Steel Institute (AISI)—should be referenced in project specifications when applicable. **Trade association specifications** contain the requirements among the companies within a given industry.

3. **MANUFACTURER'S SPECIFICATIONS.** These specifications contain a manufacturer's precise description for the manner and process for making, constructing or compounding, and using any items the manufacturer produces. They should not be referenced or copied verbatim in project specifications but maybe used to aid in preparing project specifications.

PROJECT SPECIFICATIONS

Construction drawings are supplemented by written **project specifications.** Project specifications give detailed information regarding materials and methods of work for a particular construction project. They cover various factors relating to the project, such as general conditions, scope of work, quality of materials, standards of workmanship, and protection of finished work.

The drawings, together with the project specifications, define the project in detail and show exactly how it is to be constructed. Usually, any set of drawings for an important project is accompanied by a set of project specifications. The drawings and project specifications are inseparable. The drawings indicate what the project specifications do not cover; the project specifications indicate what the drawings do not portray, or they further clarify details that are not covered amply by the drawings and notes on the drawings. When you are preparing project specification, it is important that the specifications and drawings be closely coordinated so that discrepancies and ambiguities are minimized. Whenever there is conflicting information between the drawings and project specs, the specifications take precedence over the drawings.

Organization of Specifications

For consistency, the Construction Standards Institute (CSI) organized the format of specifications into 16 basic divisions. These divisions, used throughout the military and civilian construction industry, are listed in order as follows:

1. **General Requirements.** Includes information that is of a general nature to the project, such as inspection requirements and environmental protection.

2. **Site Work.** Includes work performed on the site, such as grading, excavation, compaction, drainage, site utilities, and paving.

3. **Concrete.** Precast and cast-in-place concrete, formwork, and concrete reinforcing.

4. **Masonry.** Concrete masonry units, brick, stone, and mortar.

5. **Metals.** Includes such items as structural steel, open-web steel joists, metal stud and joist systems, ornamental metal work, grills, and louvers. (Sheet-metal work is usually included in Division 7.)

6. **Wood and Plastics.** Wood and wood framing, rough and finish carpentry, foamed plastics, fiber-glass reinforced plastics, and laminated plastics.

7. **Thermal and Moisture Protection.** Includes such items as waterproofing, dampproofing, insulation, roofing materials, sheet metal and flashing, caulking, and sealants.

8. **Doors and Windows.** Doors, windows, finish hardware, glass and glazing, storefront systems, and similar items.

9. **Finishes.** Includes such items as floor and wall coverings, painting, lathe, plaster, and tile.

10. **Specialties.** Prefabricated products and devices, such as chalkboards, moveable partitions, fire-fighting devices, flagpoles, signs, and toilet accessories.

11. **Equipment.** Includes such items as medical equipment, laboratory equipment, food service equipment, kitchen and bath cabinetwork and counter tops.

12. **Furnishings.** Prefabricated cabinets, blinds, drapery, carpeting, furniture, and seating.

13. **Special Construction.** Such items as prefabricated structures, integrated ceiling systems, and swimming pools.

14. **Conveying Systems.** Dumbwaiters, elevators, moving stairs, material-handling systems, and other similar conveying systems.

15. **Mechanical Systems.** Plumbing, heating, air conditioning, fire-protection systems, and refrigeration systems.

16. **Electrical Systems.** Electrical service and distribution systems, electrical power equipment, electric heating and cooling systems, lighting, and other electrical items.

Each of the above divisions is further divided into sections. You can find a discussion of the required sections of Division 1 in *Policy and Procedures for Project Drawing and Specification Preparation,* MIL-HDBK-1006/1. The Division 1 sections, sometimes referred to as "boilerplate", are generally common to all projects that are accomplished under a construction contract.

Divisions 2 through 16 contain the technical sections that pertain to the specific project for which the spec writer has prepared the specification. These technical sections follow the CSI-recommended three-part section format. The first part, **General,** includes requirements of a general nature. Part 2, **Products,** addresses the products or quality of materials and equipment to be included in the work. The third part, **Execution,** provides detailed requirements for performance of the work.

Guidance

Usually, the engineer or spec writer prepares each section of a specification based on the appropriate guide specification listed in the most recent edition of *Engineering and Design Criteria for Navy Facilities,* MIL-BUL-34. This military bulletin (issued quarterly by the Naval Construction Battalion Center, Port Hueneme, California) lists current NAVFACENGCOM guide specifications, standard specifications and drawings, definitive drawings, NAVFAC design manuals, and military handbooks that are used as design criteria.

As discussed earlier, when writing the specifications for a project, you must modify the guide specification you are using to fit the project. Portions of guide specifications that concern work that is not included in the project will be deleted. When portions of the required work are not included in a guide specification, then you must prepare a suitable section to cover the work, using language and form similar to the guide specification. Do not combine work covered by various guide specifications into one section unless the work is minor in nature. Do NOT reference the guide specification in the project specifications. You must use the guide spec only as a manuscript that can be edited and incorporated into the project specs.

The preceding discussion provides only a brief overview of construction specifications. For additional guidance regarding specification preparation, you should refer to MIL-HDBK-1006/1.

MATERIAL ESTIMATING

A **material estimate** is a listing and description of the various materials required to construct a given project. An **estimator** is one who evaluates the requirements of a construction task and determines the quantities of materials needed to accomplish that task As an EA2, you maybe called upon to assist in preparing material estimates, especially for bulk materials, such as fill materials, concrete, and asphaltic paving materials. To be a **good** estimator, you must have sound and thorough construction knowledge and experience, and you must be familiar with the techniques and pitfalls of material estimating. It is beyond the scope of this book to give you the construction knowledge and experience you will need; however, this section does introduce you to some of the techniques and pitfalls that you will use or encounter when estimating material requirements.

USE OF DRAWINGS AND SPECIFICATIONS

Construction drawings are the main basis for defining required construction activities and for measuring quantities of material. Accurate estimating requires a thorough examination of the drawings. All notes and references should be read carefully, and all details and reference drawings should be examined. The orientation of sectional views should be checked carefully. Dimensions shown on drawings or computed figures shown from those drawings should be used in preference to those obtained by scaling distances. An overall dimension shown on a drawing should be checked to see if it tallies with the sum of the partial lengths. If scaling is unavoidable, the graphic scale must be checked for possible expansion or shrinkage at a rate different from that of other parts of the drawing. The revision block should be checked for changes made to the drawings. The construction plan, the specification, and the drawing must be verified to see if they are, in fact, all talking about the same project. When there are inconsistencies between general drawings and details, details should be followed unless they are obviously wrong. When there are inconsistencies between drawings and specifications, the specifications should be followed.

The estimator must first study the specifications and then use them with the drawings when preparing quantity estimates. The estimator should become thoroughly familiar with all the requirements stated in the specifications. Most estimators will have to read the specifications more than once to fix these requirements in their minds. If the estimator makes notes while reading the specifications, these notes will prove helpful when the drawings are examined. In the notes, the estimator should list items of work or materials that are unusual or unfamilar. These notes should also contain reminders for use during examination of the drawings. A list of activities and materials that are described or mentioned in the specifications will be helpful in checking quantity estimates.

The *Seabee Planner's and Estimator Handbook,* NAVFAC P-405, is a publication that has been prepared specifically for the Seabee estimator. Whenever possible, the tables and the diagrams contained in the P-405 are based on the Seabees' experience. Where suitable information was not available, construction experience was adjusted to represent production under the range of conditions encountered in Seabee construction. Using the P-405 will save you time in preparing estimates and, when understood and used properly, will give accurate results.

Need for Accuracy

Quantity estimates are used as a basis for purchasing materials, for determining equipment, and for determining manpower requirements. They are also used in scheduling material deliveries, equipment, and manpower. Because of this widespread use, accuracy in preparing quantity estimates is very important, especially since an error in quantity tends to multiply itself; for example, consider that a certain concrete slab is to measure 100 feet by 800 feet. If the estimator misreads the dimension for the 800-foot side as 300 feet, the computed area of the slab will be 30,000 square feet, when it should actually be 80,000 square feet. Since this area will be the basis for ordering materials, there will be a shortage of concrete ingredients, lumber, reinforcing materials, and everything else involved in mixing and pouring the concrete. This includes equipment time, manpower, and man-hours.

Checking Estimates

Quantity estimates should be checked in a manner that will eliminate as many errors as possible. One of the best ways to check your quantity estimate is to have another person make an independent estimate and then to compare the two estimates after both are completed. Any differences should be checked to see which estimate is right. A less effective way of checking is for another person to take your quantity estimate and check all measurements, recordings, computations, extensions, and copy work.

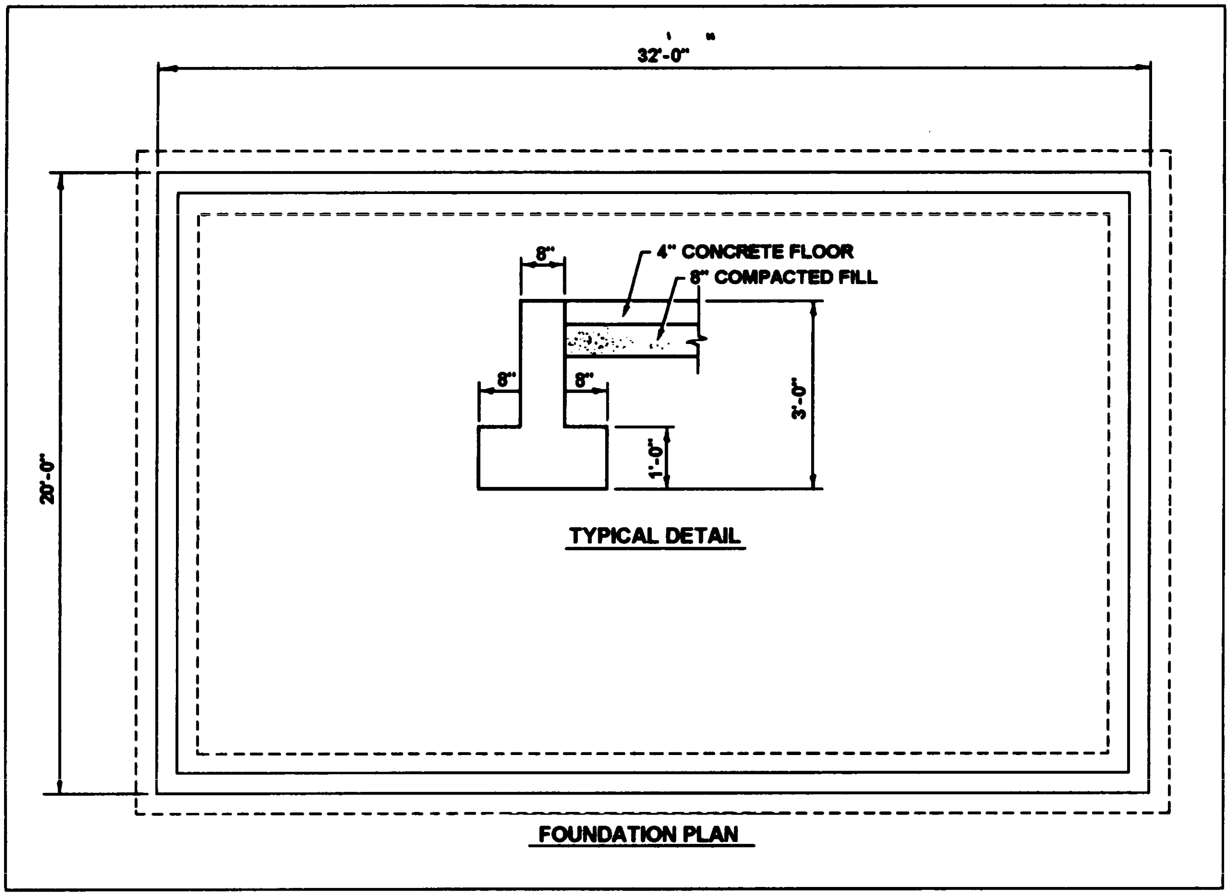

Figure 5-2.—Foundation plan and detail.

Sources of Error

Failure to read all the notes on a drawing or failure to examine reference drawings results in many omissions; for example, an estimator may overlook a note that states "symmetrical about ℄" and thus compute only half of the required quantity.

Errors in scaling obviously mean erroneous quantities. Great care should be taken in scaling drawings so that correct measurements are recorded Some common scaling errors are using the wrong scale and failing to note that a detail being scaled is drawn to a scale different from that of the rest of the drawing. Remember that some drawings are not drawn to scale. These, of course, cannot be scaled for dimensions.

Sometimes a wrong interpretation of a section of the specifications can cause errors in the estimate. If the estimator has any doubt concerning the meaning of any portion of the specification, he should request an explanation of that portion.

Omissions are usually the result of careless examination of the drawings. Thoroughness in examining drawings and specifications will usually eliminate errors of omission. Checklists should be used to assure that all activities or materials have been included in the estimate. If drawings are revised after takeoff, new issues must be compared with the copy used for takeoff and appropriate revisions made in the estimate.

Construction materials are subject to waste and loss through handling, cutting to fit, theft, normal breakage, and storage loss. Failure to make proper allowance for waste and loss results in erroneous estimates.

Other sources of error are copying errors, inadvertent figure transpositions, and computational and arithmetic errors.

ESTIMATING BULK MATERIAL REQUIREMENTS

All material estimates, including those for bulk materials, are used as a basis for material procurement and as a check to determine if sufficient materials are available to constructor complete a project. In general, the term *bulk material* refers to concrete, bituminous paving materials, and mineral products, such as sand, gravel, or rock. A few examples of estimating these materials are described below.

Concrete

Estimating the amount of concrete required for a project consists of determining the volume (in cubic yards or, in many locations outside the United States, in cubic meters) of the spaces that will be occupied by the concrete. As an example, let's look at figure 5-2. This figure shows the foundation plan and a typical foundation detail for a small 20 foot by 32 foot building. As shown in the detail, the foundation is continuous and the floor is a 4-inch-thick concrete slab. Our task is to determine the amount of concrete that will be required for the foundation and slab. Since in any concrete job a certain amount of concrete will be unavoidably lost during placement, we will include a 10-percent waste factor. You can find this waste factor listed in the P-405.

Although we could proceed in various ways to estimate the amount of concrete that is required, an easy method is tabulated as follows:

Foundation wall:

(32.00 ft x .67 ft x 2 fi) x 2 = 85.76 cu ft

(18.67 ft x .67 ft x 2 ft) x 2 = 50.04 cu ft

Footing:

(33.33 ft x 2 ft x 1 ft) x 2 = 133.032 cu ft

(17.33 ft x 2 ft x 1 ft) x 2 = 69.32 cu ft

Slab:

18.67 ft x 30.67 ft x .33 ft = 188.96 cu ft

527.40 cu ft

x 1.10 (10% waste)

580.14 cu ft

= 21 cu yd

From the above tabulation, you can see that separate estimates were prepared for the foundation wall, footing, and slab. You can also see that both the foundation wall and the footing were further subdivided based on the length and width of the building; for example, the foundation wall consists of two walls measuring 32 feet long and two measuring 18 feet 8 inches long (allowing for overlap at the foundation corners). Then, the separate estimates were added together, the waste factor was applied, and the final cubic feet of concrete was converted to cubic yards.

Now let's see how much compacted fill will be required for this job. For this example, we will assume that the project specifications call for sand to be used as the fill material.

Figure 5-2 shows that the fill material is to be 8 inches thick after compaction. Therefore, the volume of the compacted fill is 383.65 cubic feet. However, from your knowledge of soils, you know that compacted sand occupies less volume than loose sand. Since the sand for this project will be delivered to the jobsite in a loose condition, a compaction factor must be applied. NAVFAC P-405 lists compaction factors for various materials. For sand, the compaction factor listed is 1.17. So, the total amount of sand required for this project is 383.65 x 1.17=448.87 cubic feet, or 16.6 cubic yards. Again, however, we know that a certain amount of sand will be wasted. So, let's increase the total by 10 percent. Now we need approximately 18 cubic yards of sand for the job.

Bituminous Paving

Although not always, most bituminous paving projects that are accomplished by the Seabees use hot-mixed bituminous concrete that is purchased from a central plant. In this case, the job of estimating consists of determining the compacted volume, in cubic feet, of the pavement. This volume is then multiplied by the unit weight of the mix, in pounds per cubic foot (pcf), and the final result is converted to tons of mix required. An equation for determining the required tons of mix can be expressed as follows:

$$\text{Tons of mix} = \frac{L \times W \times T \times UW}{12 \times 2000}$$

Where:

L = Length of paved area in feet

W = Width of paved area in feet

T = Compacted thickness of the pavement in inches

UW = Unit weight of the mix in pounds per cubic foot

To illustrate the use of this formula, let's assume that we are estimating a 2-inch-thick hot-mix bituminous pavement on a 150-foot by 600-foot parking lot. The unit weight (which usually ranges from 140 to 160 pcf) should be determined from laboratory testing when possible; however, when the unit weight is not known, an estimated weight of 160 pcf maybe used. In this example, let's assume a unit weight of 147 pcf. From this, we can estimate the tons of plant mix required by substitution into the above formula as follows:

$$\frac{600 \times 150 \times 2 \times 147}{12 \times 2000} = 1{,}102.5 \textit{ tons.}$$

Then if we include a loss factor of, let's say 5 percent, we will need 1,158 tons of plant mix for this parking lot.

Now, let's assume that this same parking lot is to be laid over a compacted-soil subbase. In this case, we will need a prime coat also. The prime coat is a low-viscosity liquid bitumen that is sprayed on the subbase. It provides a seal and promotes adhesion between the subbase and the pavement. To estimate the amount of bitumen required for the prime coat, multiply the area to be treated by the rate of application The estimate should include enough bitumen for an additional width of 1 foot on each side of the pavement. A formula for estimating the number of gallons of primer needed is as follows:

$$Gallons = \frac{L \times W \times AR}{9}$$

Where:

L = Length of paved area in feet

W = Width of paved area in feet

AR = Application rate of bitumens in gallons per square yard

So, if the project specs for the parking lot we have been discussing call for an application rate of 0.3 gallons of prime coat per square yard of surface and if we assume a 5 percent loss factor, how many gallons of primer will be required? You can try this one on your own.

ADVANCED BASE PLANNING

During World War II when bases were constructed across the island chains of the Pacific Ocean, it became apparent that significant savings in both time and material could be realized if units of materials, equipment, and personnel required to perform specific functions were standardized. This was the beginning of the Advanced Base Functional Components (ABFC) System that is still in use today. In this section we will briefly discuss the ABFC System and the *Facilities Planning Guide,* NAVFAC P437.

ADVANCED BASE FUNCTIONAL COMPONENTS SYSTEM

A thorough discussion of the Advanced Base Functional Components System may be found in the *Naval Construction Force (NCF) Manual,* NAVFAC P-315, and in volume II of the *Facilities Planning Guide,* NAVFAC P-437. Briefly, however, the overall ABFC System comprises a preplanned collection of individual functional **components,** each of which is designed and organized to perform a specific function at an advanced base. These functional components are given code numbers and names to indicate their function; for example, Component P-26 is a Seabee Team, and Component N-24A is a 750-man tent camp.

By using the ABFC System, planners for logistics, facilities, and construction can readily identify the equipment, facilities, materials, construction effort, and other pertinent information that is needed for each component. The basic document that identifies all of this data is the NAVFAC P-437.

NAVFAC P-437

The *Facilities Planning Guide,* NAVFAC P-437, is the basic tool that you should consult when tasked to assist in planning the construction of an advanced base. This document identifies the structures and supporting utilities of the Navy ABFC System. It was developed to make preengineered facility designs and corresponding material lists available to planners at all levels. While these designs relate primarily to expected needs at advanced bases and to the Navy ABFC System, they can also be used to satisfy peacetime requirements. Facilities, logistic, and construction planners will each find the information required to select and document the material necessary to construct facilities.

NAVFAC P437 consists of two volumes. Although it may seem unusual to do so, let's first discuss volume II.

Volume II

Volume II of the P-437 is organized into three parts. **Part 1 (Components)** contains data displays foreachof the ABFC components and is indexed by code number. These data displays list and describe the **facilities** that make up each ABFC component. Figure 5-3 is an

COMPONENT P17 — OCT 22 82

FACILITY	DESCRIPTION	FACILITY CAPACITY	QTY	COMPONENT CAPACITY	WEIGHT SHORT TON	CUBE MEAS TON	DOLLAR VALUE	CONST EFFORT MANHOURS
851 10A	ROAD WITH DRAINAGE 1 MILE	14000 SY	1	14000 SY	38.8	76.3	16,206	3,330
				TOTAL NORTH (TEMPERATE)	139.5	263.1	321,810	5,517
				TOTAL TROPICAL (BASIC)	122.2	220.4	274,418	5,477

COMPONENT P17

CONST STD	LAPSED DAYS	LAND ACRES	POWER KVA CONNECTED	POWER KVA DEMAND	WATER GPD	SEWER GPD	FUEL GAL/30DAYS HEATING DSL	FUEL GAL/30DAYS HEATING MOGAS	FUEL GAL/30DAYS PWR GEN DSL
INIT	0	.6	25	14	3,600	3,600	25,608	1,101	2,000

SKILLS MANHOURS	EA	BU	UT	CE	SW	EO	CM	NS
	104	158	493	594	329	2,298	0	1,541

COMPONENT P25

NAVAL MOBILE CONSTRUCTION BATTALION

PROVIDES PERSONNEL,ADMINISTRATION,SUBSISTANCE,
EQUIPMENT,AND MINIMAL HOUSING REQUIRED FOR THE
MOBILIZATION OF ONE MOBILE CONSTRUCTION BATTALION.

SITE PLAN 6027643 — MAJOR REV 11 12 76

FACILITY	DESCRIPTION	FACILITY CAPACITY	QTY	COMPONENT CAPACITY	WEIGHT SHORT TON	CUBE MEAS TON	DOLLAR VALUE	CONST EFFORT MANHOURS
123 10A	MOGAS STORAGE-DISPENSING FACILITY	1 OL	1	1 OL	6.4	23.5	48,832	208
123 10F	DIESEL STOR-DSPNSG FACIL 200000 GAL	1 OL	1	1 OL	8.7	35.9	86,106	484
143 45E	ARMORY SEMITRAILER	210 SF	1	210 SF	7.6	82.2	14,061	175
214 20M	A CO AUTO VEHICLE SHOP	4000 SF	1	4000 SF	5.1	11.1	23,450	156
215 10A	WEAPONS REPAIR SEMITRAILER	210 SF	1	210 SF	4.5	78.7	12,475	48
218 20A	A COMPANY CONSTRUCTION EQUIP SHOP	4000 SF	1	4000 SF	5.1	11.0	23,257	136
219 10J	B C AND D COMPANY SHOPS MINIMAL	5872 SF	1	5872 SF	3.4	12.1	29,163	92
219 10M	CENTRAL TOOL ROOM (MINIMUM)	4000 SF	1	4000 SF	1.7	5.3	10,631	46
441 10S	WAREHOUSE GENERAL STORAGE MIN	4000 SF	3	12000 SF	3.9	12.0	24,910	120
530 10B	MEDICAL/FIRST AID INITIAL	936 SF	2	1872 SF	5.8	12.6	8,345	110
540 10J	DENTAL CLINIC SEMI-TRAILER MOUNTED	2 OU	1	2 OU	10.1	104.7	93,197	17
610 10PS	SPECIAL SERVICES/POST OFFICE	936 SF	1	936 SF	.6	2.5	3,173	33
610 10V	OFFICE ADMINISTRATIVE MINIMAL	936 SF	10	9360 SF	6.0	25.0	31,727	200
722 10AM	GALLEY MESS FIELD W/CNTNR REFR-FRZR	800 MN	1	800 MN	62.8	267.3	237,143	1,027
722 10BM	BAKERY PLANT FIELD PORTABLE	1500 MN	1	1500 MN	2.9	6.5	4,238	61
723 60BX	EXCHANGE-BARBER SHOP	936 SF	1	936 SF	.6	2.5	3,173	20
723 61A	SHOWER TRAILER 24-SHOWER HEAD GED	1 EA	6	6 EA	13.8	42.6	94,800	102
725 10V	TROOP HSG EMERG W/OUT WASHROOMS	3744 SF	2	7488 SF	8.2	28.0	27,119	320
725 10W	TROOP HSG EMERG W/O SHOWERS ENLIST	8424 SF	6	50544 SF	60.6	201.6	185,554	2,424
725 10YD	QUARTERS F/AIR DET	5632 SF	1	5632 SF	4.5	17.4	30,372	88
730 40M	LAUNDRY TRAILER-MOUNTED	280 SF	1	280 SF	9.9	55.0	92,721	40
811 10AU	ELECTRIC POWER PLANT DIESEL 2-200KW	400 KW	1	400 KW	11.9	15.7	111,911	106
812 30PC	ELECTRICAL DISTRIBUTION LINE-EXPED	2000 LF	1	2000 LF	30.8	38.8	222,253	2,270
831 30A	LEACH FIELD	1 EA	3	3 EA	1.2	5.7	1,561	396
841 10M	WATER TREATMENT FACILITY 1500 GPH	30 KG	2	60 KG	11.0	19.0	33,825	82
841 40E	WATER STORAGE POTABLE	30000 GA	2	60000 GA	6.0	10.6	32,660	134
842 10J	WATER DISTRIBUTION LINE POTABLE	7640 LF	1	7640 LF	15.1	27.7	41,460	480
851 10B	ROAD UNSTABILIZED W/DRAINAGE	33066 SY	1	33066 SY	4.9	14.2	6,142	777
872 10B	SECURITY FENCING	1980 LF	4	7920 LF	28.2	66.4	30,315	4,216
872 20D	BUNKER COMMAND POST	1 EA	3	3 EA	36.9	44.1	17,661	2,652
				TOTAL NORTH (TEMPERATE)	378.2	1,279.7	1,582,045	17,018
				TOTAL TROPICAL (BASIC)	365.4	1,238.5	1,500,341	16,668

COMPONENT P25

CONST STD	LAPSED DAYS	LAND ACRES	POWER KVA CONNECTED	POWER KVA DEMAND	WATER GPD	SEWER GPD	FUEL GAL/30DAYS HEATING DSL	FUEL GAL/30DAYS HEATING MOGAS	FUEL GAL/30DAYS PWR GEN DSL
INIT	0	150.0	360	244	40,363	33,960	65,820	2,884	1,340

SKILLS MANHOURS	EA	BU	UT	CE	SW	EO	CM	NS
	181	2,457	1,724	2,197	457	4,041	0	5,961

COMPONENT P26

SEABEE TEAM

PROVIDES PERSONNEL AND EQUIPMENT REQUIRED
TO ESTABLISH AND DEPLOY A SEABEE TEAM.

SITE PLAN NONE — MAJOR REV 04 11 74

FACILITY	DESCRIPTION	FACILITY CAPACITY	QTY	COMPONENT CAPACITY	WEIGHT SHORT TON	CUBE MEAS TON	DOLLAR VALUE	CONST EFFORT MANHOURS
143 77A	STORAGE OPERATIONAL	107 SF	1	107 SF	1.1	21.4	10,000	4
219 10H	SHOP SEABEE TEAM	936 SF	1	936 SF	.7	2.8	3,920	22
722 10AG	GALLEY-MESS SEABEE TEAM	13 MN	1	13 MN	3.6	29.9	30,317	40
723 20A	SHOWER/WR 100 MAN 16X32 TENT	512 SF	1	512 SF	5.1	34.3	12,224	428
723 20J	LATRINE	336 SF	1	336 SF	2.7	5.8	1,336	123
725 10R	QUARTERS-TROOP HOUSING	936 SF	1	936 SF	.7	2.9	3,651	35
811 10CF	ELECTRIC GEN STA 2-30KW 60HZ	60 KW	1	60 KW	5.3	8.5	38,981	77
841 10U	WATER TREATMENT FACILITIES	30 KG	1	30 KG	1.2	3.3	9,889	13
				TOTAL NORTH (TEMPERATE)	20.3	108.9	110,316	742
				TOTAL TROPICAL (BASIC)	19.8	107.0	108,076	726

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Figure 5-3.—Typical data display for a component.

FACILITY 123 10E   PLANNING FACTOR VH/100,MIN 2   OCT 22 82

FUEL STORAGE AND DISPENSING FACILITY

NAVFAC DRAWING NUMBER NETWORK   MAJOR REV. 02 10 78

ASSEMBLY	DESCRIPTION	ZONE	QTY.	WEIGHT POUNDS	CUBIC FEET	DOLLAR VALUE	CONST EFFORT MANHOURS
20010	TANK FUEL PILLOW 3000 GALLON		1	719.1	25.8	3,917.63	4
20135	FUEL LINE W/APPURTENANCES		1	1,154.7	18.6	2,180.89	72
20234	PUMP FUEL OIL ROTARY 20 GPM		1	243.0	4.2	588.41	24
20307	NOZZLE DISPENSING STAND		2	355.7	47.9	1,576.60	16

	SHORT TON	MEAS TON				
TOTAL NORTH (TEMPERATE)	1.2	2.4	2,472.5	96.5	8,263.53	116
TOTAL TROPICAL (BASIC)	1.2	2.4	2,472.5	96.5	8,263.53	116

FACILITY 123 10E   PRIMARY UNIT OF MEASURE   2 OL   SECONDARY UNIT OF MEASURE   20 GM

CONST STD	LAPSED DAYS	LAND ACRES	POWER KVA CONNECTED	DEMAND	VOLTS	PHASE	WATER TOT. GPD	WATER PEAK GPM	SEWER GPD	RECOV. CODE
INIT	3	.05	1	1	208	3	0	0	0	A

FUEL (GAL/30DAYS) HEATING DSL	MOGAS	PWR GEN DSL	EA	SKILLS MANHOURS BU	UT	CE	SW	EO	CM	MS
0	0	0	0	0	101	13	0	2	0	0

NOTES -THIS FACILITY RECEIVES MOGAS OR DIESEL FUEL FROM TANK TRUCKS OR TRAILERS.

WHEN THIS FACILITY IS USED TO STORE AND DISPENSE DIESEL FUEL,DIESEL FUEL SHOULD BE FILTERED PRIOR TO DELIVERY TO THIS FACILITY.

ELECTRICAL LOAD F/PUMP: 3/4 HP,208 V,60 HZ,3-PHASE

FACILITY 123 10F   PLANNING FACTOR NA

DIESEL OIL STORAGE AND DISPENSING 200000 GAL

NAVFAC DRAWING NUMBER NETWORK   MAJOR REV. 03 11 77

ASSEMBLY	DESCRIPTION	ZONE	QTY.	WEIGHT POUNDS	CUBIC FEET	DOLLAR VALUE	CONST EFFORT MANHOURS
20002	TANK FUEL PILLOW 50000 GAL		4	7,698.4	547.2	51,124.44	352
20124	HOSE MANF F/200000 GAL TANK ARR		1	642.2	55.8	1,954.19	2
20204	FUEL TRANSFER ASSEMBLY 350 GPM		1	3,774.9	470.3	13,670.99	44
20305	FUEL DISPENSING ASSY PORTABLE		1	1,619.1	53.2	6,457.53	36
20307	NOZZLE DISPENSING STAND		1	177.8	23.9	788.30	8
20506	FUEL FILTER AND METER ASSY 600 GPM		1	3,478.8	284.3	12,110.31	42

	SHORT TON	MEAS TON				
TOTAL NORTH (TEMPERATE)	8.7	35.9	17,391.2	1,434.7	86,105.76	484
TOTAL TROPICAL (BASIC)	8.7	35.9	17,391.2	1,434.7	86,105.76	484

FACILITY 123 10F   PRIMARY UNIT OF MEASURE   1 OL   SECONDARY UNIT OF MEASURE   350 GM

CONST STD	LAPSED DAYS	LAND ACRES	POWER KVA CONNECTED	DEMAND	VOLTS	PHASE	WATER TOT. GPD	WATER PEAK GPM	SEWER GPD	RECOV. CODE
TEMP	6	1.28	17	8	208	3	0	0	0	A

FUEL (GAL/30DAYS) HEATING DSL	MOGAS	PWR GEN DSL	EA	SKILLS MANHOURS BU	UT	CE	SW	EO	CM	MS
0	490	0	8	8	108	0	20	324	0	16

FACILITY 123 10G   PLANNING FACTOR VH/100 OL,2MIN

FUEL STORAGE-DISPENSING STATION 100BBL

NAVFAC DRAWING NUMBER NONE   MAJOR REV. 08 06 75

ASSEMBLY	DESCRIPTION	ZONE	QTY.	WEIGHT POUNDS	CUBIC FEET	DOLLAR VALUE	CONST EFFORT MANHOURS
12037	FOUNDATION F/BOLTED TANKS		1	1,516.1	27.3	89.74	28
12702	STABILIZED SURFACE 200SY		1	564.0	22.0	55.87	2
20008	OVERFLOW 2N F/100-250-500 BBL TANKS		1	105.6	1.1	53.35	10
20236	PUMP CNTFGL FUEL OIL 75 GPM		1	253.0	2.6	384.81	24
20507	FILTER-SEPARATOR LIQ FUEL 50 GPM		2	930.2	48.0	541.12	18
20623	PIPING LIQ FL F/100BBL STOR DSPNSG		1	1,660.0	28.1	5,162.01	174
20705	TANK FUEL OIL 1250 GAL P-1 PONTOON		1	4,277.6	211.4	2,404.69	53
30303	PERIMETER LIGHTING 4-250W HPS		1	1,152.8	112.6	1,568.83	17
31001	ELEC SERVICE ENTRANCE ASSY 1AWG		1	611.0	11.6	358.71	21
35000	FLOAT LEVEL CONTROL		1	120.5	2.2	605.67	26
42001	TANK STEEL 100BBL		1	3,264.0	114.0	3,062.00	104

	SHORT TON	MEAS TON				
TOTAL NORTH (TEMPERATE)	7.2	14.5	14,454.8	580.9	14,286.80	477
TOTAL TROPICAL (BASIC)	7.2	14.5	14,454.8	580.9	14,286.80	477

FACILITY 123 10G   PRIMARY UNIT OF MEASURE   1 OL   SECONDARY UNIT OF MEASURE   75 GM

CONST STD	LAPSED DAYS	LAND ACRES	POWER KVA CONNECTED	DEMAND	VOLTS	PHASE	WATER TOT. GPD	WATER PEAK GPM	SEWER GPD	RECOV. CODE
TEMP	10	.03	1	1	208	3	0	0	0	C

PAGE 6   123 10G

Figure 5-4.—Typical data display for a facility.

example of one of the data displays that you can find in part 1.

As you can see, figure 5-3 is for Component P-25. The name of this component is Naval Mobile Construction Battalion. The specific function, or purpose, of this component is shown directly below the component name. Listed below the function are all of the facilities that comprise Component P-25. For each facility, you find the single-facility capacity, total quantity, and total facility capacity required for the component; for example, there is a total of two water-storage facilities (Facility Number 841 40E) required for the complete component. Each of these storage facilities has a capacity of 30,000 gallons, and the total water-storage capacity for the component is 60,000 gallons. Also listed for each facility is the weight, cube, dollar value, and estimated construction effort for the total quantity of each facility. At the bottom of figure 5-3, you find additional information concerning the complete component. This includes a breakdown, by Seabee rating, of the estimated direct-labor man-hours that are needed to construct the component.

Part 2 (Facilities) includes a data display for each of the ABFC facilities. This part, indexed by facility number, is used to identify the **assemblies** that are required for each facility. For our discussion, let's stay with the requirements for the P-25 Component and look at the data display for Facility Number 123 10F. This data display, found in part 2, is shown in figure 5-4.

At the top of this data display (fig. 5-4) is the facility number and nomenclature of the facility. Below this, you see a listing, by assembly number, of all of the assemblies that are needed for one complete facility. This listing includes the description, quantity, weight, cubic feet, dollar value, and the estimated construction effort required for each assembly. Below the listing of assemblies, you also find other information regarding the complete facility; for example, you can see that Facility 123 10F requires a land area of 1.28 acres, that a 30-day supply of gasoline (MOGAS) will be needed, and that the estimated EA direct labor required to install this facility is 8 man-hours.

Part 3 (Assemblies) is indexed by assembly number and contains data displays that list all of the materials required for each assembly. For an example, let's look at the data display for Assembly Number 20002 that is required for Facility 123 10F. This data display, which you could find in part 3, is shown in figure 5-5. On this display, you see the national stock number (NSN), description, unit of issue, quantity, weight, cubic feet, and dollar value for each line item of material that is required for one complete assembly. Also, on this data display, you can find the estimated number of man-hours and the recommended size of crew needed to assemble and install one of these assemblies.

Volume I

Refer again to figures 5-3,5-4, and 5-5. In each of these figures, you see reference to a drawing. It is for these drawings that you use volume I of the P-437. Volume I contains reproducible engineering drawings and is organized as follows:

Part 1 (Component Site Plans) is indexed by component designation and includes typical site plans for the ABFC components. When a component does not have a site plan, the word *None* appears on the data display for the component.

Part 2 (Facility Drawings and Networks) is indexed by facility number and contains detailed construction drawings of the ABFC facilities. Also included in part 2 are construction networks. A network is a diagram that is used to guide and manage a construction project. It includes information, such as the sequence of construction activities, start and finish dates of each construction activity, duration of each activity, and other information that is of use to the crew leaders, supervisors, and managers of a project. The *Seabee Planner's and Estimator Handbook,* NAVFAC P-405, provides detailed guidance on reading and preparing construction networks.

Part 3 (Assembly Drawings) contains working drawings of the ABFC assemblies. It is indexed by assembly number.

The above is only a brief overview of Advanced Base Functional Components. For more information, you should refer to the NAVFAC P-437, volume II.

QUESTIONS

Q1. What type of guide specifications is mandatory for use when preparing project specifications for a nonspecialized structure?

Q2. When there is conflicting information between the drawings and the specifications, which takes precedence?

Q3. Into how many divisions are project specifications divided?

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ASSEMBLY 20002 ZONE 20002

COG	STOCK NUMBER	DESCRIPTION	UI	QTY	WEIGHT POUNDS	CUBIC FEET	DOLLAR VALUE
9C	4710-00-273-1041	PIPE CULV NESTABLE 16 GA AL 12N X 2FT	EA	4	26.40	2.1600	51.04
9C	4710-00-639-9445	PIPE STL BI STD WT 2N NPT	FT	20	75.00	.7800	25.60
9C	4720-00-878-8887	HOSE ASSY RBR FUEL-XFR 4N X 10 FT FEM X MALE QDISC	EA	3	171.00	7.5000	628.74
9C	4730-00-068-0393	REDUCER QUICK DISCONNECT CAM-LOCKING TYPE 4N	EA	1	10.00	.3000	95.72
	3	FEMALE X 6N MALE					
9C	4730-00-068-9286	COUPLING HALF QDISC CAM-LOCKING TYPE FEMALE X	EA	2	16.00	.4000	51.58
	6	INTERNAL PIPE THREAD 4N					
9C	4730-00-196-2079	NIPPLE PP STL BI 4 X 4N NPT	EA	1	3.15	.0600	2.31
9C	4730-01-078-8234	REDUCER,QDISC,CAM-LOCKING TYPE,6N FEMALEX4N MALE	EA	1	12.00	.4000	64.47
9C	4820-00-469-7825	VALVE GATE QIK-OPNG BRS 2N NPT	EA	1	11.00	.2000	74.69
9Z	5330-00-899-4509	GASKET-COUPLING HALF QDISC CAM-LOCKING TYPE 4N	EA	3	.06	.0102	.96
2C	5430-00-182-8181	TANK, FABRIC, COLLAPSIBLE, 50000 GAL,FUEL STORAGE,	EA	1	1,600.00	125.0000	11,786.00
	1	NYLON CLOTH, MATERIAL IMPREGNATED AND COATED					
	1	INSIDE AND OUTSIDE WITH POLYURETHANE, 5.67FT HIGH,					
	1	65FT LONG, 24FT WIDE FILLED					
	ASSEMBLY 20002			TOTAL	1,924.61	136.8102	12,781.11

FUEL (GAL/30DAYS)

HEATING DSL	HEATING MOGAS	PWR GEN DSL	EA	BU	UT	CE	SW	EO	CN	NS	CONST EFFORT MANHOURS
0	0	0	2	0	2	0	0	81	0	3	88

(S K I L L S M A N H O U R S: EA through NS)

NOTE - CREW SIZE: 2 EA, 1 UT, 4 EO, 3 CN

ASSEMBLY 20004 ZONE 20004

TANK FUEL PILLOW 10000 GALLON

NAVFAC DRAWING NUMBER 6002630 MAJOR REVISION DATE 02 09 82

COG	STOCK NUMBER	DESCRIPTION	UI	QTY	WEIGHT POUNDS	CUBIC FEET	DOLLAR VALUE
9C	4710-00-273-1041	PIPE CULV NESTABLE 16 GA AL 12N X 2FT	EA	4	26.40	2.1600	51.04
9C	4710-00-639-9445	PIPE STL BI STD WT 2N NPT	FT	20	75.00	.7800	25.60
9C	4720-00-878-8887	HOSE ASSY RBR FUEL-XFR 4N X 10 FT FEM X MALE QDISC	EA	3	171.00	7.5000	628.74
9C	4730-00-068-9286	COUPLING HALF QDISC CAM-LOCKING TYPE FEMALE X	EA	2	16.00	.4000	51.58
	6	INTERNAL PIPE THREAD 4N					
9C	4730-00-196-2079	NIPPLE PP STL BI 4 X 4N NPT	EA	1	3.15	.0600	2.31
9C	4820-00-469-7825	VALVE GATE QIK-OPNG BRS 2N NPT	EA	1	11.00	.2000	74.69
9Z	5330-00-899-4509	GASKET-COUPLING HALF QDISC CAM-LOCKING TYPE 4N	EA	3	.06	.0102	.96
2C	5430-00-052-3412	TANK, FABRIC, COLLAPSIBLE, 10000 GAL, PETRO ONLY,	EA	1	387.00	24.7400	6,121.00
	2	20.5FT X 20.5FT X 4FT HIGH FILLED, ELASTOMERIC-					
	2	COATED FABRIC, 4 INCH QUICK-DISCONNECT FILLER/DIS-					
	2	CHARGE ASSEMBLY					
	ASSEMBLY 20004			TOTAL	689.61	35.8502	6,955.92

FUEL (GAL/30DAYS)

HEATING DSL	HEATING MOGAS	PWR GEN DSL	EA	BU	UT	CE	SW	EO	CN	NS	CONST EFFORT MANHOURS
0	0	0	2	0	2	0	0	31	0	3	38

(S K I L L S M A N H O U R S: EA through NS)

NOTE - CREW SIZE: 2 EA, 1 UT, 3 EO, 3 CN

ASSEMBLY 20005 ZONE 20005

MANIFOLD AND HOSE FOR 10000 GALLON TANKS

PROVIDES NECESSARY MANIFOLDS AND HOSE FOR CROSS-
CONNECTING FOUR 10000 GALLON PILLOW TANKS.

NAVFAC DRAWING NUMBER NONE MAJOR REVISION DATE 02 09 82

COG	STOCK NUMBER	DESCRIPTION	UI	QTY	WEIGHT POUNDS	CUBIC FEET	DOLLAR VALUE
9C	3835-00-986-2328	MANIFOLD ASSEMBLY,CROSS,FOUR WAY,VALVED,FUEL-XFR	EA	3	31.02	3.4800	2,400.00
	8	ONE 4N MALE X THREE 4N FEM QDISC CONNS					
9C	4720-00-817-8373	HOSE ASSY RBR FUEL-XFR 4N X 50 FT FEM X MALE QDISC	EA	2	220.00	18.0000	331.36
9C	4720-00-865-1234	HOSE ASSY RBR FUEL-XFR 4N X 50 FT FEM X MALE QDISC	EA	6	2,130.00	54.0000	3,036.84
9C	4730-00-935-1613	ADAPTER QDISC CAM-LOCKING TYPE MALE X MALE 4X4N	EA	2	16.00	.4000	71.20
9C	4820-00-999-3680	VALVE FILLING FUEL F/FABRIC TANK 4N	EA	4	140.00	6.0000	1,908.60
	ASSEMBLY 20005			TOTAL	2,537.02	79.8800	7,748.00

FUEL (GAL/30DAYS)

HEATING DSL	HEATING MOGAS	PWR GEN DSL	EA	BU	UT	CE	SW	EO	CN	NS	CONST EFFORT MANHOURS
0	0	0	0	0	8	0	0	0	0	0	8

(S K I L L S M A N H O U R S: EA through NS)

NOTE - CREW SIZE: 2 UT

ASSEMBLY 20007 ZONE 20007

OVERFLOW 4 INCH FOR 1,000-3,000 BBL TANKS

NAVFAC DRAWING NUMBER 6002572 MAJOR REVISION DATE 01 30 73

COG	STOCK NUMBER	DESCRIPTION	UI	QTY	WEIGHT POUNDS	CUBIC FEET	DOLLAR VALUE
9C	4710-00-203-0186	TUBE STL PTD-FNSH 4N X 20FT GRV	LG	2	148.00	7.0000	52.32
9C	4730-00-142-1590	COUPLING CLAMP F/GRV PP MI 4N W/RBR GSKT	EA	4	36.00	.6000	15.04
9C	4730-00-202-7212	COUPLING PP STL UNCTD 4N GRV X MPT	EA	3	17.10	.3600	18.63
9C	4730-00-273-8322	ELBOW PP MI UNCTD 900 4N GRV	EA	2	19.00	.4440	8.98
9Z	5305-00-071-2508	SCREW CAP 0.25-20X1.5N UNC HEX HD CD PL STL	HD	1	4.00	.0400	2.55
9Z	5310-00-761-6882	NUT 0.25-20 UNC HEX CD PL STL	HD	1	.01	.0001	.53
9Z	5310-00-809-3078	WASHER FL 0.31N ID 0.73N OA DIA RND CD PL STL	HD	2	1.16	.0116	.90
9Z	5340-00-246-5126	HANGER PP MI HINGED RING 4N PP W/3/4N ROD SKT	EA	4	6.00	.2000	22.36
9Z	9510-00-189-1553	STEEL BAR HRL FLT .25X1	FT	2	1.70	.0044	.68
9Z	9515-00-204-3868	STEEL STRIP HRL .1875X4	FT	2	5.10	.0132	1.76
9Z	9520-00-954-5668	STEEL ANGLE 3X3X1-4	FT	2	9.80	.0214	2.42
	ASSEMBLY 20007			TOTAL	245.87	8.6947	126.17

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Figure 5-5.—Typical data display for an assembly.

Q4. As a surveyor, you have been tasked to stake out a sanitary sewer line for a project. In which division of the specifications should you find the gradient requirements for the sewer piping?

Q5. Referring to the above question, in what part of the specification division should you find the gradient requirements?

Q6. What estimating publication has been prepared specifically for Seabee construction?

Q7. You have been tasked to prepare the concrete estimate for a 150-foot long retaining wall that has atypical cross section as shown in figure 5-6. Including a lo-percent waste factor, how many cubic meters of concrete will be required?

Q8₀ When detaining how many sheets of plywood will be required as forming material for the retaining wall shown in figure 5-6, what waste factor (according to NAVFACP-405) should you use if the plywood is to be used twice?

Q9. What is the basic planning tool that you should use when assisting in the planning of an advanced base?

Q10. Where in the Facilities Planning Guide, NAVFAC P-437, will you find recommended crew sizes?

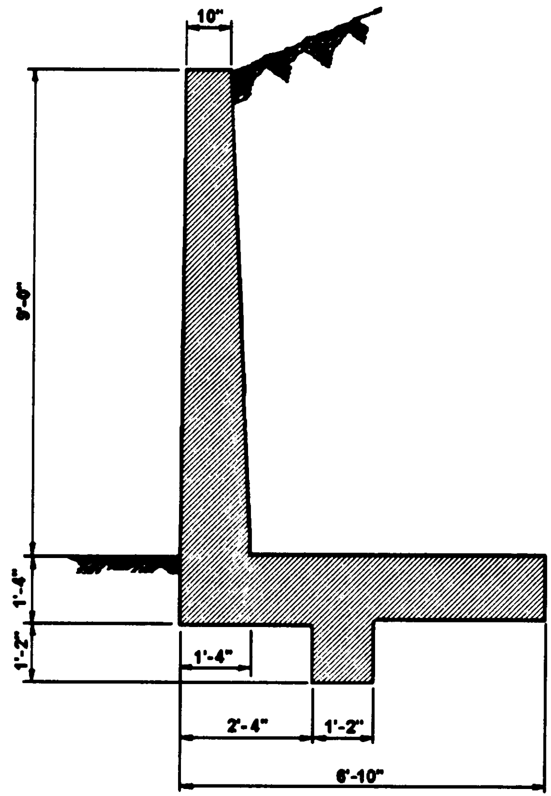

Figure 5-6.—Typical retaining wall.